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(54) Titre : PROCEDE D'OBTENTION D'UN MATERIAU DE CONSTRUCTION THERMO-ISOLANT  
 (54) Title: PROCESS FOR OBTAINING A THERMALLY INSULATING BUILDING MATERIAL

(57) Abrégé/Abstract:

A process for preparing heat-insulating constructional material based on an alkalized and flooded siliceous raw material fabricated by comminuting solid ingredients and mixing all the raw ingredients, steaming a raw mixture and thermally bloating intermediate products obtained from the steamed raw mixture is designed for utilisation as warmth-keeping fills and light-weight concrete aggregates (in a particulate form) and as structural elements for buildings and constructions (in the form of slabs or blocks). For the purpose of controlling the desired products in a wide range of dimensions and to achieve a greater stability in its mechanical strength and water adsorption the material is obtained by cooling the steamed raw mixture prior to its transition in a brittle condition and crushing the brittle mixture prior to bloating for obtaining the intermediate products.

## ABSTRACT OF THE DISCLOSURE

A process for preparing heat-insulating constructional material based on an alkalized and flooded siliceous raw material fabricated by comminuting solid ingredients and mixing all the raw ingredients, steaming a raw mixture and thermally bloating intermediate products obtained from the steamed raw mixture is designed for utilisation as warmth-keeping fills and light-weight concrete aggregates (in a particulate form) and as structural elements for buildings and constructions (in the form of slabs or blocks). For the purpose of controlling the desired products in a wide range of dimensions and to achieve a greater stability in its mechanical strength and water adsorption the material is obtained by cooling the steamed raw mixture prior to its transition in a brittle condition and crushing the brittle mixture prior to bloating for obtaining the intermediate products.

## **PROCESS FOR OBTAINING A THERMALLY INSULATING BUILDING MATERIAL**

### **Field of the Invention**

This invention relates to a process for obtaining thermally insulating building materials  
5 of an indeterminate composition, which are prepared by low-temperature treatment of siliceous rock having a high content of amorphous silicon dioxide, usually higher than 70%, preferably higher than 80% by weight.

Such materials can be in a particulate final state suitable for use as a loose thermal insulation, as aggregate in making mainly light-weight concrete, and as slabs or blocks which  
10 in most cases may be immediately used, preferably, as cladding for buildings and various structures.

### **Description of the Prior Art**

The above-defined materials are produced on a mass scale and are under various conflicting requirements that are becoming increasingly more rigid.

15 Actually, it is very desirable that such materials exhibit as low bulk density (for loose particles) or density (for slabs and blocks) as possible and the lowest possible heat conductivity, while offering the greatest possible strength and weather resistance, particularly under conditions characterized by freeze-defrost cycles.

It is further desirable that such materials be combinable with inert ingredients that will  
20 modify their mechanical and/or thermal properties, and be capable of production as final loose particles of arbitrary sizes and shapes or as blocks and slabs from readily accessible raw materials in a production process of a minimum power consumption, the product quality variations being kept within the narrowest range possible.

The above requirements can be now satisfied either separately or in some combinations  
25 only.

The siliceous raw materials, which are really not uncommon in the manufacture of thermally insulating building materials, are readily accessible (see, for example: Ivanenko, V.N., 'Building and civil engineering materials and shapes from siliceous rock', published 1978, by BUDIVELNYK Publishers (Kiev). Among such raw materials belong siliceous  
30 minerals, such as diatomite, tripoli, gaize, spongolite, radiolarite, and their artificially prepared analogs. Of these latter materials, sodium silicate, e.g. soluble glass, is the best known and commercially available.

Thermally insulating building materials having relatively low bulk density (less than 1000 kg/m<sup>3</sup>) and low heat conductivity are known to be obtained by preparing compositions capable of being heat expanded, forming intermediate products (preferably by agglomeration and particularly by pelletizing or jet granulation), and by expanding the intermediate products  
5 at high temperatures, usually above 800°C.

Building materials of this kind may be exemplified by a porous aggregates used in making mainly light-weight concrete and produced from siliceous rock containing from 30% to 98% by weight of silicon dioxide, not more than 20% by weight of aluminum oxide, not more than 25% by weight of calcium oxide and some other constituents. To produce such  
10 aggregate, an appropriate natural raw material is crushed, then roasted (usually in rotary kilns) at temperatures from 1080°C to 1380°C, and the resulting product is cooled (Ivanenko, V.N., "Building and civil engineering materials and shapes from siliceous rock", published 1978, by BUDIVELNYK Publishers (Kiev), see pages 49 to 58).

Cracks visible to the unaided eye can always be found in such materials, these resulting  
15 in significant water absorption and a correspondingly low frost resistance. Also, high-temperature roasting involves an economically unacceptable specific power consumption.

More preferable are processes where thermally insulating building materials are produced from a process alkalized and wetted siliceous raw material by roasting at lower temperatures.

The term "alkalized", as used herein, refers to such siliceous raw materials in which a  
20 hydroxide of an alkali metal (preferably caustic soda) is inherently present or added, and the term "wetted" means that water is used during preparation of a raw mixture at least as an ingredient indispensable for preparing intermediate products.

Known in the art are processes for obtaining thermally insulating building materials produced from such raw material, which thermally insulating building materials may be  
25 exemplified by porous aggregate for light-weight concrete (artificial "gravel" or "sand") and thermally insulating boards ("foam glass") (See Ivanenko, V.N. referred to above, pages 102 to 103 and pages 98 to 99, respectively).

Production of such materials consists in preparation of a raw mixture of 100 parts by weight of powdered siliceous rock with a particle size of up to 0.14 mm, from 8 to 22 parts by  
30 weight of a hydroxide of an alkali metal, i.e. caustic soda or caustic potash, and from 18 to 38 parts by weight of water, obtaining an intermediate product and roasting it at a temperature of 1180°C to 1200°C to attain expansion.

The materials produced by the above-outlined process, compared with the earlier-mentioned porous aggregate, do have cracks resulting in high water absorption and a low frost resistance, though the process is moderately less power intensive.

Known in the art is a process for obtaining materials based on the above mentioned soluble glass, whose characteristics in terms of integrity, water absorption and frost resistance are better, since the soluble glass inherently contains from 6 to 20% of a hydroxide of an alkali metal. Soluble glass must be powdered and water must be added in the ratio of 9:1 by weight. Then the wetted powder is formed into an intermediate product which is steamed in a gaseous atmosphere containing 50% of superheated steam at 100°C to 200°C and above 0.1 MPa gage pressure. The steamed intermediate product is further heat treated (dried and/or calcined) at a temperature above 100°C, preferably above 800°C, to attain expansion (US Pat. No. 3,498,802).

Hydrous sodium or potassium silicates present in the starting material significantly promote the forming of the intermediate product and provide for a noticeable reduction in specific power consumed in the heat treatment step.

Nonetheless, it is doubtful that porous materials of low (less than 1000 kg/m<sup>3</sup>) bulk density can be obtained from such raw materials at temperatures below 800°C .

The intermediate products at temperatures so high are expanded mainly due to polymorphic transformations in silica to result in a final product of loosened up structure and low mechanical strength, for one thing, and of the above-mentioned increased water absorption and reduced frost resistance due to disintegration of surface layers, for the other. In some cases the strength of the resultant product is too low for shipment to the site where it is to be used.

A process for obtaining thermally insulating building materials of an appreciably increased strength and exhibiting reduced water absorption has been disclosed in Ukrainian Patent No. 3802. The process is likewise notable for a reduced specific power consumption.

A thermally insulating building material of the above-mentioned properties, based on an alkalized and wetted siliceous raw material (containing in particular from 1 to 30 parts by weight of a hydroxide of an alkali metal and from 30 to 125 parts by weight of water per 100 parts by weight of the siliceous material) is obtained by comminuting solid ingredients and mixing all the ingredients, steaming the mixture (specifically in the atmosphere of a saturated steam at a temperature of 80°C to 100°C for 20 to 60 min), to produce an intermediate

product (usually by pelletizing) and heat expanding (e.g. at a temperature of 150°C to 660°C) the intermediate product. This is the process that bears closely on the invention.

Compared with other prior art processes, this one is the least power intensive; and the material produced has a comparatively low (from 50 to 950 kg/m<sup>3</sup>) and readily controllable  
5 bulk density, it is noted for a wholly satisfactory porosity such that water adsorption is no more than 32.5% at worst, on the one hand, and sufficient mechanical strength, on the other.

These advantageous features are due to the steaming of the mixture, which thereby turns into a gelled viscous sticky low-melting mass based on hydrosilicates of alkali metals. This mass is substantially impermeable to low pressure gases and steam which are common to the  
10 steaming step under indicated temperature conditions, but when expanded it is slightly permeable to gases and steam.

The low-melt mass admits of low expanding temperatures and a corresponding low specific power in obtaining a final product, while the relative gas-impermeability of the mass provides for the indicated satisfactory porosity and sufficient strength.

15 However, the final thermally insulating building material produced by the process disclosed in Ukrainian Patent No. 3802 does not possess invariable qualities. The strength of pellets varies in the range of 0.2 to 12.5 MPa, and water absorption in the range of 4% to 32.5%. What is more, in practice, on attempted control of pellet size in loose material it has  
20 appeared that the smaller the medium pellet size, the greater the number of rejected pellets due to aggregation or conglomeration of the pellets in the pelletizing and heat expanding steps; and on an attempted manufacture of building products, such as blocks and slabs, negligible cracks and a total absence of open pores in the surface layers of intermediate  
25 products have proved to be obstacles to gases to be driven off during the expansion step, and the larger the building product, the greater obstacles. Building products with some excessive (varied with composition) dimensions have all been rejected.

This undesirable outcome is due to a combination of high viscosity and stickiness of the steamed mixture with its low gas permeability.

Attempts at reducing such outcome, by adding from 1 to 150 parts by weight of an inert mineral aggregate filler incapable of combining under said conditions of steaming into  
30 hydrosilicates of alkali metals, have not been successful in noticeably doing away with quality variability in the final product.

### Summary of the Invention

Therefore, an object of the present invention is to provide a process for obtaining a thermally insulating building material capable of being made into final products of a wide variety of sizes.

5 A further object of the invention is to provide a thermally insulating building material exhibiting substantially less variable mechanical strength and water absorption.

These and other objects are accomplished by the provision of a process for obtaining a thermally insulating building material based on an alkalized and wetted natural siliceous raw material by comminuting the siliceous raw material and mixing the latter with alkaline metal  
10 hydroxide and water to produce a mixture containing from 1 to 30 weight parts of alkaline metal hydroxide and from 30 to 125 weight parts of water per 100 weight parts of siliceous raw material, steaming the mixture, and thermally expanding the intermediate products produced from the steamed mixture, wherein the intermediate products are produced by cooling the steamed mixture of the raw material until it becomes brittle and by crushing the  
15 brittle mixture into particles, which, in the initial stage of the thermal expansion, turn into a flowing state when heated to a temperature above 100°C, preferably above 200°C.

As used herein the term "steaming" refers to one of the two substantially equivalent meanings. It means either treatment of an alkalized and prewetted (at least in part ) siliceous raw material with steam to thereby warm up the raw material throughout and form  
20 hydrosilicates or saturation of an alkalized and completely prewetted siliceous raw material with steam by the action of heat from an external heat source.

The advantages of the present invention are gained due to the unexpected property that was found by experiment – it turned out that the intermediate particulate product obtained by crushing the friable body, which is nonsticky, is capable of being re plasticized, when the  
25 product is submitted to heat expansion at temperatures above 100°C, preferably above 200°C, to become substantially less sticky than the gelled low-melting mass.

This suggests that the particles of the intermediate particulate product will conglomerate under conditions that are favorable for sticking together, for example, under compression or heat expansion in bulk.

30 Conglomeration will not occur, if the intermediate particulate product is subjected to heat expansion, with agitation as by shaking, or in a free-flowing motion. Therefore a person skilled in the art is able to obtain a desired particulate product in a wide range of sizes from "sand" to "gravel" by mere selection of conventional crushing means and conditions, the

mechanical strength and water absorption of particles being substantially kept within a desired narrow range.

It will be further noted that the intermediate particulate product can be stored for long (at least for a month) in bulk without coalescing and without loss in the capability to expand, on the one hand, or it can be used to form structures such as slabs and blocks for building and construction, on the other.

The process of the invention is advantageously carried out when the mixture of the raw material is steamed with saturated steam. Further, it is advisable to steam the raw material by the action of an external heat source.

One aspect of the invention consists in that the intermediate particulate product capable of being heat expanded is classified by size prior to being expanded. An expanded particulate thermally insulating building material of a predetermined bulk density and heat conductivity, when obtained from such intermediate products, is immediately suitable for use as a thermal insulation and as a filler for light-weight concrete and it outweighs disadvantages of the expanded clay production.

Another aspect of the invention consists in that the thermally insulating building material is produced by incorporating a particulate, preferably porous filler into the crushed brittle mixture. The final material, being formed as blocks or slabs, exhibits a density of no more than  $520 \text{ kg/m}^3$ , compression strength of no less than 1.45 MPa and water absorption of no more than 22.6%.

For a particulate filler (of a predetermined average particle size) use can be made of natural materials such as pumice, tuff, shell rock, etc.; artificial porous materials such as claydite, crushed perlite, expanding vermiculite, expanded slag, porous sinter, etc.; and some other materials, mainly manufacturing wastes, for example cellulose scrap after papermaking, tan waste in leather manufacturing, and flax stock in flax processing industry.

The particulate fillers are useful for causing the intermediate product to expand between them and thus preventing formation of continuous steam and gas impermeable surface layers of substantially low heat-conductivity.

Therefore, a person skilled in the art is able (with a noticeable reduction in specific power consumption) to obtain slabs or blocks of predetermined shapes and dimensions by mere selection of intermediate product compositions and processing conditions.

### Description of the Preferred Embodiments

The invention is hereinafter explained by way of specific examples of compositions for producing the thermally insulating building material of the invention, and of a description of the production processes and test results in consideration of the tables.

- 5 Siliceous materials suitable for use in carrying out the invention and their composition are shown in Table 1.

TABLE 1

#### Composition of siliceous materials

Raw materials	Composition, % by weight								Quartz wt. %
	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	c.l.	
1	2	3	4	5	6	7	8	9	10
Opalized tuff	93.3	2.5	0.5	0.6	0.1	0.7	0.3	2.0	30.5
Silicified gaize	85.4	2.3	6.1	1.2	0.6	0.2	0.2	4.0	2.3
Tripoli	83.1	5.7	4.5	1.4	0.8	0.5	0.4	3.6	10.2
Soluble glass	68.6	1.5	1.3	0.7	0.5	24.2	0.4	2.8	0.7

10

Notes:

(a) the abbreviation "c.l." designates calcination loss as evidence that organic impurities or water in crystal hydrates are present in the raw material.

15

(b) in column 10, percentages stand for the proportion of quartz, or crystalline silicon dioxide, in the total amount of silica shown in column 2.

Sodium hydroxide in a 40% water solution was used as an experimental alkali.

The process of the invention useful in the production of the thermally insulating building material generally comprises the steps of comminuting siliceous materials preferably into particles of average size ranging from 1.0 to 2.5 mm; proportioning siliceous materials, a hydroxide of alkali metals, preferably sodium hydroxide, and water (or a solution of at least 40% caustic soda); alkalizing and wetting the siliceous material by mixing it with a hydroxide of an alkali metal and water (or with a water solution of such a hydroxide); steaming (with optional mixing) the resulting mixture at atmospheric pressure and at a temperature preferably in the range of 75°C to 90°C to attain formation of hydrated silicates, in the steaming step use being made either of a saturated steam if the siliceous raw material was wetted only partially in the preparation of the mixture, or of an external heat source to heat the mixture throughout until saturated with steam if the mixture was completely wetted; cooling the steamed mixture to about room temperature (18-25°C) or lower for a time period

sufficient for the mixture to become friable; crushing the resulting friable body to obtain a particulate intermediate product; optionally classifying the intermediate product by size; preparing a mixture of the crushed intermediate product in a required proportion with porous aggregates of a required size, placing the mixture of the crushed intermediate product and the porous aggregate in split forms for heat treatment if the final material should be made into blocks or slabs; and heat-treating (expanding) the intermediate particulate product either at a temperature preferably of 200°C to 250°C for preferably 25 to 35 min in order to produce the final material in a particulate form, or at a temperature preferably of 250°C to 450°C for preferably 2.5 to 6 hours to produce the final material in blocks or slabs.

In some cases (especially when "sand"-type small-size particles of the crushed intermediate product are used) it is advisable to add to the mixture of the crushed intermediate product and the porous aggregate a minor amount of water to make placement of the mixture and smoothing out its surface easier in preparation for heat expanding. It should be understood by those skilled in the art that vibration likewise can be resorted to.

Test materials were produced by the above-described process, including particulate materials of particle sizes up to 5 mm, from 5 to 10 mm, and from 10 to 20 mm, slabs or blocks, and cubic structures measuring 100 mm, 200 mm, and 400 mm on the edge.

For comparison, thermally insulating building materials and structures of the same shape and dimensions were produced according to Ukrainian Patent No. 3802.

Specific compositions of the raw mixtures used in the experiments and process conditions are given in Tables 2 and 3.

TABLE 2

**Compositions of raw mixtures, process conditions and physical characteristics of particulate thermally insulating building materials**

	Weight percentages of ingredients and process characteristics per sample							
	claimed process				prior art process			
	#1	#2	#3	#4	#1	#2	#3	#4
<b>Ingredients:</b>								
Opalized tuff	100	-	-	-	100	-	-	-
Silicified gaize	-	100	-	-	-	100	-	-
Tripoli	-	-	100	100	-	-	100	-
Sodium silicate in lumps	-	-	-	-	-	-	-	100
Quartz sand	-	-	-	-	-	150	-	100
Quartzite	-	-	-	-	1	-	100	-
Hydroxide of alkali metal	15	20	25	30	30	10	15	-
Water	60	50	40	30	80	30	125	30

<b>Physical characteristics:</b>								
Particle size, mm	2.5	2.0	1.5	1.0	0.14	0.14	0.14	0.1
<b>Conditions:</b>								
Steaming:								
- temperature, °C	90	80	75	75	100	80	90	90
- time, min.	45	40	40	40	60	20	30	30
Cooling:								
- temperature, °C	20	20	20	20	-	-	-	-
- time, min.	90	60	40	20	-	-	-	-
Expanding:								
- temperature, °C	200	220	250	250	660	150	300	300
- time, min.	35	30	25	25	10	120	30	30

TABLE 3

**Compositions of the raw mixtures, process conditions and physical characteristics of thermally insulating building materials in blocks**

5

	Weight percentages of ingredients and process characteristics per sample							
	claimed process				prior art process			
	#1	#2	#3	#4	#1	#2	#3	#4
<b>Ingredients:</b>								
Opalized tuff	100	-	-	-	100	-	-	-
Silicified gaize	-	100	-	-	-	100	-	-
Tripoli	-	-	100	100	-	-	100	-
Sodium silicate in lumps	-	-	-	-	-	-	-	100
Quartz sand	-	-	-	-	1	-	-	100
Quartzite	-	-	-	-	-	50	50	-
Hydroxide of alkali metal	15	20	25	30	30	15	25	-
Water	60	50	40	30	30	75	125	40
Porous filler	100	120	130	150	-	-	-	-
<b>Physical characteristics:</b>								
Particle size, mm	2.5	2.0	1.5	1.0	0.14	0.14	0.14	0.1
<b>Conditions:</b>								
Steaming:								
- temperature, °C	90	80	75	75	100	80	90	90
- time, min.	45	40	40	40	45	20	30	30
Cooling:								
- temperature, °C	20	20	20	20	-	-	-	-
- time, min.	90	60	40	20	-	-	-	-
Expanding:								
- temperature, °C	350	250	450	350	660	450	600	300
- time, min.	150	300	250	250	180	420	300	300

Note: for the porous filler use was made of the particulate thermally insulating building material produced by the process of the invention with a particle size ranging from 5 to 15 mm and bulk density of about 200 kg/m<sup>3</sup>.

The thermally insulating materials produced by the process of the invention and those produced by the prior art process (Ukrainian Patent No. 3802) were tested for the following properties:

(a) particulate materials:

- 5
- bulk density, kg/m<sup>3</sup>,
  - compression strength in a cylinder, MPa,
  - water absorption, % by weight,
  - rejects by size, % by weight;

(b) blocks and slabs:

- 10
- density, kg/m<sup>3</sup>,
  - compression strength in a cylinder, MPa,
  - water absorption, % by weight,
  - cavernous rejects, % by weight.

15 Density and bulk density, compression strength and water absorption were in all cases determined by conventional techniques.

Rejects by size were determined as a proportion of particles of a size in excess of a predetermined average particle size in the aggregate produced. Cavernous rejects were determined as a proportion of manifestly cavernous cubic structures among the structures produced. The cubic structures were produced in batches of 100 each.

20 Test results for the particulate and block materials are summarized in Tables 4 and 5 respectively. In the Tables, the units of measurement are not shown since they correspond to those mentioned above.

TABLE 4

25 **Quality characteristics of particulate thermally insulating building materials**

Property	Test data per sample #							
	claimed process				prior art process			
	#1	#2	#3	#4	#1	#2	#3	#4
Bulk density	320	240	200	130	50	950	205	245
Compression strength	1.1	0.83	0.57	0.45	0.02	12.5	0.27	0.51
Water absorption	5.4	7.6	11.1	22.8	32.5	15.5	26.9	9.7
Rejects by size:								
up to 5 mm	0	3	2	6	100	93	100	100
5 to 10 mm	2	2	4	5	60	46	52	49
10 to 20 mm	0	2	3	5	25	23	33	27

TABLE 5

**Quality characteristics of thermally insulating building materials in blocks**

Property	Test data per sample #							
	claimed process				prior art process			
	#1	#2	#3	#4	#1	#2	#3	#4
Density	520	490	440	430	580	1050	640	1110
Compression strength	2.1	2.0	1.57	1.45	1.02	4.5	1.2	7.51
Water absorption	15.2	17.5	21.1	22.6	35.2	18.4	32.1	15.1
Rejects with edge length of:								
100 mm	0	0	0	3	0	0	10	0
200 mm	0	0	0	5	62	49	55	50
400 mm	0	2	4	4	100	100	100	100

5

The data given in the Table 4 show that the bulk density of the particulate thermally insulating building materials produced by the process of the invention is notably less variable compared with that of the materials produced by the prior art process and can be controlled by changing proportions of the ingredients for the raw mixtures; the materials produced by the process of the invention feature a narrower range of variability in terms of compression strength and water absorption, which are also controllable, and where bulk density is approaching that of the materials produced by the prior art process these properties are more preferable; and lastly the materials produced by the process of the invention were rejected by size more than 10, 20, and 30 times as rarely as the materials produced by the prior art process, and the particle size was practically immaterial in that.

15

Further, it should be noted that the ranges of controlling quality characteristics of the materials produced by the process of the invention, which are certainly nonexhaustive, are suited to customers' demands.

The data of Table 5 show that the density of the thermally insulating building materials produced by the process of the invention in blocks (much as of the particulate materials) is also notably less variable compared with that of the materials produced by the prior art process and can be controlled by changing proportions of the ingredients for the new mixtures; the materials produced by the process of the invention in blocks (much as the particulate materials) feature a narrower range of variability in terms of compression strength and water absorption, which are also controllable, and where density is approaching that of the materials produced by the prior art process these properties are more preferable; and lastly

25

cavernous materials produced by the process of the invention were detected rather rarely and dimensions of blocks (or slabs) are practically immaterial to the occurrence of cavities, while the materials produced by the prior art process measuring more than 100 mm on the edge are rejected at an unacceptable level.

- 5 Again, it is to be noted that the upper limit of density of the materials produced by the process of the invention in blocks, when the particulate material produced by the process of the invention, is used as a porous aggregate filler for the production of the blocks, proves to be lower than the lower limit of density of the prior art materials of the same type, produced by the prior art process, both water absorption and strength being invariable.

**Claims**

We claim:

1. A method for the manufacture of a thermally insulating building material, which comprises the steps of:
  - (a) steaming a comminuted alkalized and wetted naturally-occurring siliceous raw material at a temperature of 75 °C to 90 °C and at atmospheric pressure to produce a gelled viscose sticky mass;
  - (b) cooling said mass to about room temperature until it becomes friable;
  - 10 (c) crushing said cooled mass into an intermediate particulate product; and
  - (d) heating said intermediate particulate product to a temperature of about 200 °C to about 450 °C and for a time period sufficient to attain expansion thereof into a thermally insulating building material.
- 15 2. The method of claim 1 wherein said intermediate particulate product is mixed with a particulate filler, placed in a form and subjected to said heating step at a temperature of about 250 °C to about 450 °C for about 2.5 hours to about 6 hours whereby the thermally insulating building material in the form of plates or slabs is obtained.
3. The method of claim 2 wherein said particulate filler is porous.